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Decision Support System for the Selection of Prospective Recipients of the Smart Indonesia Program (PIP) Assistance using the Topsis Method

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Abstract

This study aims to implement a Decision Support System (DSS) using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method to determine the recipients of the Indonesia Smart Program (PIP) at SMPNegeri 36 Medan. The TOPSIS method was chosen for its ability to produce objective and measurable results based on five main criteria: parents' occupation (C1), number of dependents (C2), parents' income (C3), student status (C4), and distance from home to school (C5). Data were collected from 306 students, with assigned weights of 25% for income, 25% for occupation, 20% for dependents, 20% for student status, and 10% for distance.The research stages included scoring, decision matrix formation, data normalization, weighted normalization, and determining positive and negative ideal solutions to obtain preference values (V_i). The results show that students with $V \geq 0.5$ are categorized as eligible, while those with $V < 0.5$ are not eligible. Out of 306 students, 103 were eligible and 203 were not. The implementation of the TOPSIS method in DSS effectively assists schools in selecting PIP recipients more quickly, objectively, and accurately, ensuring that aid is given to students who truly need it.

***Keywords**: Decision Support System, Normalization, Python, Scholarship, TOPSIS*

1. Introduction

Education plays a vital role in improving the quality of human resources; however, the high cost of education remains a major challenge, limiting equal access to educational opportunities, particularly for students from low-income families [1]. To address this issue, the Indonesian government introduced the Program Indonesia Pintar (PIP), which provides educational assistance to students aged 6–21 years from economically disadvantaged families to support their education and reduce school dropout rates [1], [2]. Nevertheless, the implementation of PIP still faces several challenges, including inaccurate beneficiary targeting and inefficient selection procedures. At SMP Negeri 36 Medan, the selection process involved 306 applicants competing for 103 available scholarships, and the manual management of applicant data often made it difficult to identify the most deserving recipients objectively and efficiently.

Therefore, a multi-criteria decision support system is required to improve the selection process. One suitable approach is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method, which identifies the best alternative based on its proximity to the positive ideal solution and its distance from the negative ideal [3], [4], [5]. Previous studies have demonstrated that TOPSIS is effective in supporting the selection of scholarship and financial aid recipients in a more objective, accurate, and transparent manner[6], [7], [8]. Therefore, this study aims to optimize the selection process of Program Indonesia Pintar (PIP) recipients at SMP Negeri 36 Medan using the TOPSIS method.

2. Theoretical Review

2.1. Program Indonesia Pintar (PIP)

The Program Indonesia Pintar (PIP) is an Indonesian government initiative that provides educational assistance to students from economically disadvantaged families to ensure equal access to education. The program offers financial support and educational opportunities for students from poor and vulnerable households, reflecting the government's commitment to educational equity. According to academics, including Dr. Andi Zulkarnain, PIP serves as an important intervention to reduce educational inequality by providing financial assistance while promoting awareness of the importance of education. In addition, the National Development Planning Agency

(Bappenas) recognizes PIP as part of Indonesia's social protection system that contributes to achieving the Sustainable Development Goals (SDGs), particularly Goal 4 on quality education.

PIP targets students enrolled in both formal and non-formal educational institutions, with priority given to children from low-income families, beneficiaries of KPS, KKS, or PKH programs, orphans, students affected by natural disasters, school dropouts, students with disabilities, and vocational students in strategic sectors such as agriculture, fisheries, forestry, and maritime studies. The implementation of the program involves coordination among schools, education authorities, technical directorates, and distribution agencies to ensure that educational assistance is delivered effectively and reaches eligible recipients.

The effectiveness of PIP is measured by its ability to achieve its intended objectives of expanding educational access and supporting disadvantaged students. While effectiveness refers to achieving desired goals, efficiency emphasizes obtaining satisfactory outcomes with optimal resource utilization. According to Barnard (Nurudin, 2007), a program is considered effective when it achieves its objectives and efficient when it minimizes undesirable consequences while producing satisfactory results. Therefore, PIP can be regarded as an effective educational assistance program when it successfully reaches eligible beneficiaries and efficiently supports equitable access to education [1].

2.2. Selection Optimization

Selection optimization refers to a systematic effort to improve selection procedures and techniques in order to achieve the desired outcomes more effectively and accurately. It involves the application of algorithms, mathematical models, and data analysis techniques to identify the most suitable option among multiple alternatives. Selection optimization is widely applied in various fields, including employee recruitment, personnel selection, student admissions, scholarship allocation, and business decision-making processes, where objective and efficient decision-making is required.

2.3. Decision Support System

A Decision Support System (DSS) is an information system developed to assist decision-makers, particularly in semi-structured situations where analytical data processing must be combined with human judgment (Wang et al., 2019). DSS provides relevant information, analytical models, and alternative solutions to support objective and effective decision-making. Originally introduced by G. Anthony Gorry and Michael S. Scott Morton in the 1960s and formally recognized as a Decision Support System in 1971, DSS has been widely implemented in government, business, and education because of its ability to integrate data, analytical models, and user interaction [9].

The concept of DSS originated from the Management Decision System (MDS), which was designed to support decision-making for unstructured problems through the integration of computerized information systems, analytical models, and human expertise. This combination enables decision-makers to evaluate multiple alternatives systematically and produce decisions that are more accurate, efficient, and objective.

A DSS consists of four main components: the data management subsystem, which stores and manages decision-related data; the model management subsystem, which applies mathematical and analytical models; the knowledge management subsystem, which incorporates expert knowledge to solve complex problems; and the user interface subsystem, which facilitates interaction between users and the system. The overall architecture of these components is illustrated in Fig. 1.

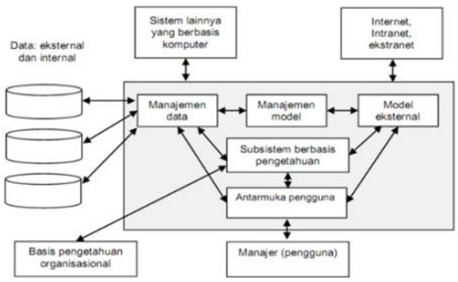

Fig. 1: SPK Schematic

The decision-making process in DSS generally includes three stages, as shown in Fig. 2. The Intelligence stage focuses on identifying and analyzing problems, the Design stage develops and evaluates possible alternatives, and the Choice stage selects and implements the most appropriate solution. These stages ensure that decisions are made systematically, objectively, and based on comprehensive evaluation.

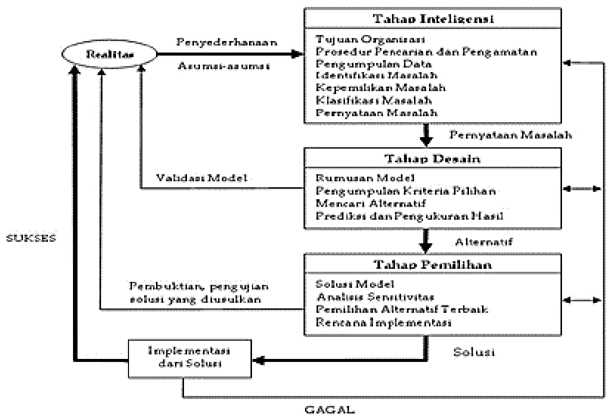

Fig. 2: Decision Making Stages

2.4. Fuzzy Logic

Fuzzy logic was introduced by Lotfi A. Zadeh in 1965 through his seminal paper Fuzzy Sets, which introduced the concept of fuzzy sets and their fundamental operations. Unlike classical logic, which assigns membership values of only 0 or 1, fuzzy logic allows membership values within the interval [0,1], enabling uncertainty to be represented using linguistic terms such as low, medium, and high. One of its major advantages is its capability to perform linguistic reasoning, making it suitable for solving complex and uncertain problems without relying solely on precise mathematical models [10].

Fuzzy set theory extends classical (crisp) set theory by assigning each element a degree of membership. A crisp set is represented as:

$$A = \{x \in \mu | x \text{ } satisfies \text{ } a \text{ } condition\} \quad (2.1)$$

Its characteristic (membership) function is defined as:

$$\mu_A(x) == \begin{cases} 1, & x \in A \\ 0, & x \notin A \end{cases} \quad (2.2)$$

For fuzzy sets, the membership degree is expressed as:

$$A = \{x, \mu_A[x] | x \in X, \mu : x \to [0,1]\} \quad (2.3)$$

where $\mu_A(x)$ represents the degree to which an element belongs to the fuzzy set (Setiadji, 2009).

A membership function maps each input value into a membership degree between 0 and 1 [11]. Common membership functions include the increasing linear function Fig.3,

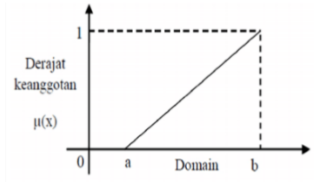

Fig. 3: Rising Representation

$$\mu(x) = \begin{cases} 0 & x \le a \\ (x-a)/(b-a) & a \le x \le b \\ 1 & x \ge b \end{cases} \quad (2.4)$$

the decreasing linear function Fig.4,

Fig. 4: Representation Down

$$\mu(x) = \begin{cases} (b-x)/(b-a) & a \le x < b \\ 0 & x \ge b \end{cases} \quad (2.5)$$

and the triangular membership function Fig. 5,

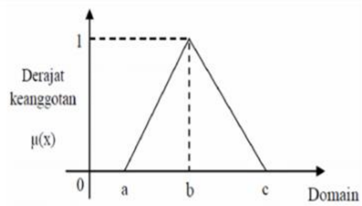

Fig. 5: Representation of Triangular Curves

$$\mu(x) = \begin{cases} 0 & x \le a \text{ } atau \text{ } x \ge a \\ \frac{x-a}{b-a} & a \le x \le b \\ 1 & b \le x \le c \\ \frac{c-a}{c-b} & \end{cases} \qquad \begin{matrix} Disisi \text{ } lain: \\ \mu(a) = 0 \\ \mu(b) = 1 \\ \mu(c) = 0 \end{matrix} \quad (2.6)$$

The trapezoidal membership function Fig. 6 is defined as:

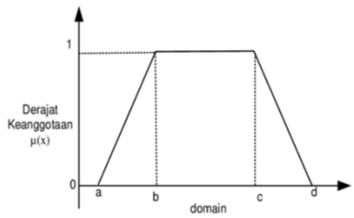

Fig. 6: Representation of Trapezium Curve

$$\mu(x) = \begin{cases} 0 & x \le a \text{ } atau \text{ } x \ge b \\ (x-a)/(b-a) & a \le x < b \\ 1 & b \le x < c \\ (d-x)/(d-c) & x \ge d \end{cases} \quad (2.7)$$

These membership functions are widely used because they effectively represent uncertainty while maintaining computational simplicity. Their flexibility makes fuzzy logic suitable for decision support systems, intelligent control, and various applications involving imprecise or uncertain information.

2.5. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is a Multi-Criteria Decision-Making (MCDM) method used to evaluate and rank alternatives based on multiple criteria. The method identifies a positive ideal solution that maximizes benefit criteria and minimizes cost criteria, as well as a negative ideal solution representing the opposite condition. The best alternative is selected according to its shortest distance from the positive ideal solution and its farthest distance from the negative ideal solution. TOPSIS has been widely adopted in various decision-making applications because of its flexibility, simple computational procedure, and ability to produce consistent and objective rankings. Previous studies have focused on improving normalization techniques, determining ideal solutions, and measuring distances between alternatives and ideal solutions[12].

The main advantages of TOPSIS include its simple and systematic computation, ease of implementation, consistency in evaluation, and straightforward interpretation of results. Furthermore, the method efficiently utilizes computational resources and converts all decision alternatives into mathematical values that can be prioritized through ranking [13]. However, TOPSIS also has several limitations. It does not explicitly consider hierarchical relationships among criteria, and the absence of task prioritization may affect the validity of criterion weighting, potentially influencing the accuracy of the final decision.

According to [14], the TOPSIS procedure consists of six main steps. First, the decision variables (alternatives and evaluation criteria) are identified. Second, the normalized decision matrix is calculated using:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij^2}}} \qquad (2.8)$$

where r_{ij} is the normalized value of alternative i on criterion j, and x_{ij} is the original decision matrix value.

Third, the weighted normalized decision matrix is obtained by multiplying each normalized value by its corresponding criterion weight:

$$v_{ij} = w_j \times r_{ij} \qquad (2.9)$$

where w_j represents the weight assigned to criterion j.

Fourth, the positive and negative ideal solutions are determined as follows:

$$A^+ = (v_1{}^+, \dots, v_n{}^+) \qquad (2.10)$$

$$A^- = (v_1{}^-, \dots, v_n{}^-) \qquad (2.11)$$

where the positive ideal solution consists of the maximum values for benefit criteria (or minimum values for cost criteria), while the negative ideal solution consists of the minimum values for benefit criteria (or maximum values for cost criteria).

Fifth, the Euclidean distances from each alternative to the positive and negative ideal solutions are calculated using:

$$S_i{}^+ = \sqrt{\sum (v_j{}^+ - v_{ij})^2} \qquad (2.12)$$

$$S_i{}^- = \sqrt{\sum (v_j{}^- - v_{ij})^2} \qquad (2.13)$$

Finally, the preference value for each alternative is computed as:

$$v_i = \frac{D_i{}^-}{D_i{}^+ + D_i{}^+}, \; 0 \le C_i{}^+ \le 1 \qquad (2.14)$$

where v_i represents the relative closeness of alternative i to the positive ideal solution. Alternatives are then ranked in descending order of their preference values, and the alternative with the highest v_i is considered the optimal choice because it is closest to the positive ideal solution and farthest from the negative ideal solution [14].

3. Research Methods

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3.1. Data Collection Methods

Data collection in this study was conducted through interviews to obtain accurate, relevant, and reliable information in accordance with the research objectives. Interviews involved direct interaction between the researcher and respondents to gather verbal data and were conducted in either a structured or unstructured manner, depending on the conditions during the data collection process.

3.2. Research Site, Duration, and Method

This study was conducted at SMP Negeri 36 Medan, Indonesia, over a period of approximately two months. A quantitative approach was employed, involving the collection, processing, and analysis of numerical data from prospective Program Indonesia Pintar (PIP) recipients. The data were converted into numerical values and evaluated using the TOPSIS method to objectively assess candidates based on multiple criteria, with the final results presented as scores and rankings.

3.3. Data Source

This study utilized primary data obtained directly from the source. The data were collected through questionnaires distributed to students of SMP Negeri 36 Medan by school staff. These primary data served as the basis for evaluating prospective recipients of the Program Indonesia Pintar (PIP).

3.4. Research Procedure

This research was conducted through several stages, as illustrated in Figure 1.1. The process began with problem identification at SMP Negeri 36 Medan regarding the selection of eligible recipients of the Program Indonesia Pintar (PIP). Subsequently, the research objectives were defined, followed by a literature review to establish the theoretical foundation of the study. Data were then collected through interviews and document analysis. Based on the collected data, a Decision Support System (DSS) utilizing the TOPSIS method was designed by determining the evaluation criteria and processing the relevant information. Finally, the proposed method was tested to evaluate its effectiveness and accuracy in supporting objective decision-making for PIP recipient selection.

4. Results and Discussion

A Decision Support System (DSS) is a computer-based system designed to assist decision-making by analyzing data, providing relevant information, and generating alternative solutions. DSS is commonly used in complex situations that require extensive data analysis and processing. Rather than replacing human judgment, it supports decision-makers in making faster, more accurate, and higher-quality decisions.

4.1. Variable Determination

In this study, the variables are represented by C, which denote the evaluation criteria used in the decision-making process. The criteria include parents' occupation (C1), number of dependents (C2), parents' income (C3), child status (C4), and distance from home to school (C5).

Table 1: Criteria for Prospective PIP Recipients

Criteria	Code
Parents' Occupation	C1
Number of Dependents	C2
Parents' Income	C3
Child Status	C4
Distance from Home to School	C5

4.2. Data Collection

The data used in this study were obtained directly from SMP Negeri 36 Medan, located at Jl. STM No. 12C, Siti Rejo 2, Medan Amplas. A total of 306 students participated as respondents in this research, as presented in Appendix 1.

4.3. Criteria Weight Assignment

The next step was to assign weights to each criterion according to its level of importance in the decision-making process. The weights were expressed as percentages to reflect the priority of each criterion, as presented in Table 2**.**

Table 2: Criteria Weights

Criteria	Weight (%)
Parents' Income	25
Number of Dependents	20
Parents' Occupation	25
Child Status	20
Distance from Home to School	10

4.4. Student Criteria Assessment

Based on the collected data, five main criteria were established for selecting recipients of the Program Indonesia Pintar (PIP). Each criterion was evaluated using a scale from 1 to 3, where 1 indicates low priority, 2 indicates moderate priority, and 3 indicates high priority. The scoring criteria used in this study are presented in Table 3

Table 3: Criteria Scoring Rules

Code	Criteria	Criteria Value	Score
C1	Parents' Occupation	1. Laborer	3
		2. Self-Employed	2
		3. Government or Private Employee	1
C2	Number of Dependents	1. More than 4 dependents	3
		2. 3-4 dependents	2
		3. 1- 2 dependents	1
C3	Parents' Income	4. < Rp. 1.500.000	3
		5. Rp. 1.500.000 – Rp. 3.000.000	2
		1. > Rp. 3.000.000	1
C4	Child Status	1. Orphan (both parents deceased)	3
		2. Single-parent orphan	2
		3. Both parents alive	1
C5	Distance from Home to School	1. 5 – 10 KM	3
		2. 1 – 5 KM	2
		3. ≤ 1 KM	1

4.5. Decision Matrix Construction

At this stage, a decision matrix was constructed using the preference values of each criterion for all alternatives. The matrix serves as the basis for the TOPSIS calculation process by representing the performance of each alternative against the established criteria.

Table 4: Decision Matrix

Alternative	C_1	C_2	C_3	C_4	C_5
A1	3	2	2	1	2
A2	1	1	2	1	2
A3	2	1	2	1	2
A4	3	1	2	1	3
A5	3	2	2	1	2
A6	2	2	2	1	3
A7	3	1	1	1	3
A8	3	1	2	1	3
A9	3	2	2	1	2
A10	3	2	2	1	2

4.6. Normalization of the Decision Matrix

Since each criterion is measured using different units, such as income, distance, and ordinal status values, normalization is required to transform all criteria into a comparable scale. In this study, vector normalization was applied using the following formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij^2}}}$$

The divisor for each criterion was calculated as the square root of the sum of squared values in the corresponding column. The resulting divisors were 44.2041 for Parents' Occupation (C1), 32.3883 for Number of Dependents (C2), 36.3043 for Parents' Income (C3), 18.0831 for Child Status (C4), and 42.4735 for Distance from Home to School (C5). These values were subsequently used to obtain the normalized decision matrix.

4.7. Weight Normalized Matrix V ($v_{ij} = w_j \times r_{ij}$)

After obtaining the normalized decision matrix, each criterion was multiplied by its corresponding weight to produce the weighted normalized matrix. The weights assigned to the criteria were 0.25 for Parents' Occupation (C1), 0.20 for Number of Dependents (C2), 0.25 for Parents' Income (C3), 0.20 for Child Status (C4), and 0.10 for Distance from Home to School (C5). For example, the weighted normalized values for alternative A1 were calculated as 0.01697 (C1), 0.01235 (C2), 0.01377 (C3), 0.01106 (C4), and 0.00471 (C5). The same calculation was then applied to all alternatives to obtain the complete weighted normalized matrix, which served as the basis for determining the positive and negative ideal solutions in the TOPSIS method.

4.8. Determination of Positive Ideal Solution (A^+) and Negative Ideal Solution (A^-)

The next step in the TOPSIS method is to determine the positive ideal solution (A^+) and the negative ideal solution (A^-). The positive ideal solution represents the best value for each criterion, while the negative ideal solution represents the worst value. Since all criteria in this study are considered benefit criteria, A^+ is obtained from the maximum value of each criterion, whereas A^- is obtained from the minimum value.

Table 5: Positive Ideal Solution (A^+) and Negative Ideal Solution (A^-)

Solution A	C1 MAX	C2 MAX	C3 MAX	C4 MAX	C5 MAX
A+	0,016966763	0,018525226	0,020658727	0,022120051	0,007063224
Solution A-	C1 MIN	C2 MIN	C3 MIN	C4 MIN	C5 MIN
A-	0,005655588	0,006175075	0,006886242	0,011060025	0,002354408

The positive and negative ideal solutions obtained from the weighted normalized matrix were subsequently used to calculate the separation distance of each alternative from the ideal solutions in the next stage of the TOPSIS procedure.

4.9. Calculation of Separation Distances from the Ideal Solutions

The next step in the TOPSIS method is to calculate the separation distance of each alternative from the positive ideal solution (S_i^+) and the negative ideal solution (S_i^-). These distances indicate how close each alternative is to the ideal best and ideal worst conditions. For example, the calculation for alternative A1 resulted in a positive separation distance of $S_i^+ = 0.014609$ and a negative separation distance of $S_i^- = 0.014800$. The same procedure was applied to all alternatives to obtain their respective distances from the positive and negative ideal solutions. These values were then used in the next stage to calculate the preference value and determine the ranking of prospective PIP recipients.

4.10. Preference Value Calculation and Ranking

The final step of the TOPSIS method is to calculate the preference value (V) for each alternative using the separation distances from the positive and negative ideal solutions. The preference value was calculated using the following formula:

$$V_i = \frac{S_i^-}{S_i^+ + S_i^-}$$

For example, the preference value of alternative A1 was calculated as follows:

$$V_1 = \frac{0{,}0147999260}{0{,}0146088776 + 0{,}0147999260} = \frac{0{,}0147999260}{0{,}0294088036} \approx 0{,}503248$$

A higher preference value indicates that an alternative is closer to the positive ideal solution and farther from the negative ideal solution. Based on the manual calculations performed for all alternatives (see Appendix 6), students with $V \geq 0.5$ were classified as eligible to receive the Program Indonesia Pintar (PIP) assistance. The top-ranked eligible students are presented in Table. 6.

Table 6: Eligible PIP Recipients Based on TOPSIS Ranking

Rank	Alternative	Student Name	Preference Value (V)
1	A189	Muhammad Alfatih Sabil	0,711645
2	A113	Mhd. Hayqal Hakim Irawan	0,682913
3	A79	Shania Twin Natalina Situngkir	0,677272
4	A202	Zahara Rahmayani	0,667217
5	A117	Dwi Prayoga	0,667217
6	A55	Hazryan Ahmad Zakawali	0,667217
7	A227	Rehan Anugrah Nst	0,667217
8	A114	Alhafizh Ibnu Azmi	0,655531
9	A136	Vanesha Oktania Sitorus	0,655531
10	A220	Muhammad Daffa Abqori Hrp	0,624689

Based on the TOPSIS calculation results, alternatives with preference values greater than or equal to 0.5 were considered eligible for PIP assistance. The ranking results provide an objective basis for selecting students who are most deserving of financial support according to the established criteria.

4.11. Development of the Website for Selecting Program Indonesia Pintar (PIP) Recipients Using the TOPSIS Method

A web-based Decision Support System (DSS) was developed to support the objective selection of Program Indonesia Pintar (PIP) recipients using the TOPSIS method. The website provides student data management, criteria evaluation, ranking calculations, and reporting features in a transparent and user-friendly manner. The system can be accessed through TOPSIS Scholar Rank Website, allowing users to perform eligibility assessments more efficiently, accurately, and accountably.

1. **Home Page**

Fig. 7: Home Page

The Home Page serves as the main entry point of the website. It provides an overview of the system, including its objectives, benefits, and the application of the TOPSIS method in supporting the selection of PIP recipients. This page also facilitates navigation to other menus available in the system.

2. **Complete Candidate Data Menu**


Program Indonesia Pintar – Ranking with TOPSIS

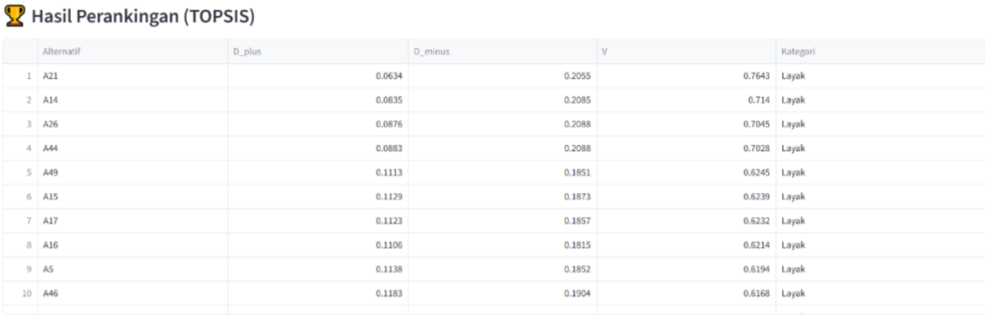
Data Lengkap Calon Penerima

Alternatif	Nama_Siswa	Pekerjaan_Ortu	C0_Pekerjaan	C1_Tanggungan	C2_Penghasilan	C3_Status	C4_Jarak
A1	ADELIA PUTRI	BURUH	3	3	1800000	0	2.8
A2	ADELIA ZAHRA	PEGAWAI SWASTA	1	2	3000000	0	1.7
A3	ADINDA NURFADILLAH	WIRASWASTA	2	2	1500000	0	1.5
A4	ADRIAN RAFA WAHYUDI	BURUH	3	1	1500000	0	0.75
A5	AZRY RIFANDI	SUPIR	3	3	1500000	0	3
A6	BAGAS PRATAMA	WIRASWASTA	2	3	1500000	0	0.5
A7	BRIYA NAURAH SETIA	WIRASWASTA	2	2	6000000	0	0.7
A8	DANDI AULIA	BURUH	3	2	1500000	0	0.35
A9	ELVINA RAMADANI	MUSIMAN	3	4	2000000	0	1.1
A10	FANISA FEBRIADI	BANGUNAN	3	3	1500000	0	2.2

Fig. 8: Complete Candidate Data Menu

This menu displays detailed information about all registered students. The data include alternative codes, student names, parents' occupation, number of dependents, parents' income, child status, and distance from home to school. The information is presented in a structured table and serves as the primary dataset for the TOPSIS calculation process.

3. TOPSIS Ranking Results Menu


Hasil Perankingan (TOPSIS)

	Alternatif	D_plus	D_minus	V	Kategori
1	A21	0.0634	0.2055	0.7643	Layak
2	A14	0.0835	0.2085	0.714	Layak
3	A26	0.0876	0.2088	0.7045	Layak
4	A44	0.0883	0.2088	0.7028	Layak
5	A49	0.1113	0.1851	0.6245	Layak
6	A15	0.1129	0.1873	0.6239	Layak
7	A17	0.1123	0.1857	0.6232	Layak
8	A16	0.1106	0.1815	0.6214	Layak
9	A5	0.1138	0.1852	0.6194	Layak
10	A46	0.1183	0.1904	0.6168	Layak

Fig. 9: TOPSIS Ranking Results Menu

The TOPSIS Ranking Results menu presents the final results of the TOPSIS calculations. It displays each alternative's distance from the positive ideal solution (D+), distance from the negative ideal solution (D−), preference value (V), and eligibility category. Based on these values, students are classified as eligible or ineligible for PIP assistance, ensuring objective and transparent decision-making.

4. Preference Score (V) Menu

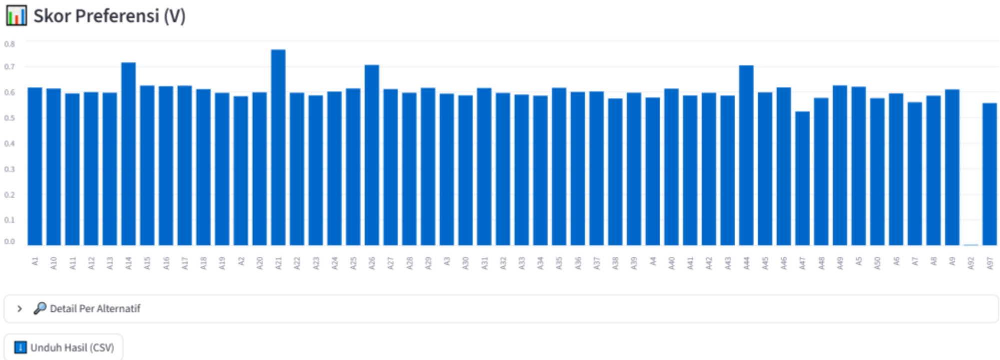


Fig. 10: Preference Score (V) Menu

This menu visualizes the preference values of all alternatives through a bar chart. The graphical representation allows users to compare student eligibility levels more effectively. Additional features include detailed alternative information and the ability to download results in CSV format for reporting and further analysis.

5. Add Data Menu

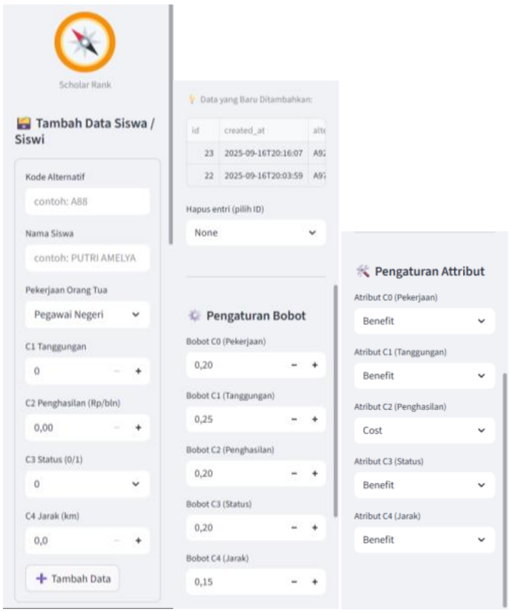


Fig. 11: Add Data Menu

The Add Data menu allows users to enter and manage student information, including alternative code, student name, parents' occupation, number of dependents, monthly income, child status, and distance from home to school. The system also provides features for viewing newly added records, deleting data, adjusting criterion weights, and defining criteria as either Benefit or Cost attributes.

These features ensure that the TOPSIS calculations are performed accurately and consistently, supporting transparent and reliable decision-making in the selection of PIP recipients.

5. Conclusion

The results of this study demonstrate that the implementation of a Decision Support System (DSS) using the TOPSIS method can effectively support the selection of Program Indonesia Pintar (PIP) recipients at SMP Negeri 36 Medan in a more objective, efficient, and measurable manner. The evaluation was based on five criteria: parents' occupation, number of dependents, parents' income, child status, and distance from home to school. Out of 306 students evaluated, 103 were identified as eligible for PIP assistance, while 203 were classified as ineligible. These findings indicate that TOPSIS is effective in reducing subjectivity and improving the fairness and accuracy of decision-making based on students' economic and social conditions.

For future work, the TOPSIS method should be implemented in a fully computerized system to improve processing speed, accuracy, and reliability. In addition, the criterion weights should be periodically reviewed to ensure their relevance to current policies and requirements. Further studies may also compare TOPSIS with other multi-criteria decision-making methods, such as AHP, SAW, and MOORA, to identify the most suitable approach for transparent, objective, and accountable scholarship selection.

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